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Published in:
Meeting Abstracts - Electrochemical Society

Publication date:
2009

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Torres da Silva, I. M., Nielsen, J., Hjelm, J., & Mogensen, M. B. (2009). Comparison of the Degradation of the Polarization Resistance of Symmetrical LSM-YSZ Cells, with Anode Supported Ni-YSZ/YSZ/LSM-YSZ SOFCs. In *Meeting Abstracts - Electrochemical Society* (pp. Abstract 1508). The Electrochemical Society.

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Comparison of the degradation of the polarisation resistance of symmetrical LSM-YSZ cells, with anode supported Ni-YSZ/YSZ/LSM-YSZ SOFCs

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Symmetrical cells are a useful tool for screening electrode performance [1]. The goal of this study was to investigate how the results collected from symmetrical cells relate to results obtained on a corresponding full cell. Therefore, electrochemical impedance spectra (EIS) from a symmetrical cell and full cell were collected periodically over a longer period of time, at open circuit voltage. The operating conditions were chosen such that no degradation of the anode is expected and parameters were varied within the limits of realistic operating conditions.

The symmetrical cells were screen-printed lanthanum strontium manganite - yttria stabilized zirconia composite cathodes [LSM25.5-YSZ composites, where LSM25.5 = $(La_{0.75}Sr_{0.25})_{0.95}MnO_{3\pm\delta}$ and YSZ = ZrO_2 with 8 mol% Y_2O_3] on stabilized zirconia, YSZ, electrolyte. The full cells were planar anode supported Ni-YSZ/YSZ/LSM25.5-YSZ cells. These materials have been chosen as they are of continuing interest in the field [1, 2, 3].

The EIS data of the symmetrical and full cells were modelled using appropriate equivalent circuits [4, 5]. Using these models the influence of varying operation conditions was determined, providing information on what frequency range is affected by which physical process. Furthermore, the degradation rates of the polarisation resistance (R_p) at different operating conditions were determined.

Further analysis techniques like ADIS [6] (analysis of difference in impedance spectra) and DRT [7] (distribution of relaxation times) were applied to check whether the degradation of R_p of the full cell was due to the cathode and the cathode/electrolyte interface and not to the anode. Finally the degradation rates of R_p of the full and symmetrical cell were compared.

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